Iowa State University
Digital Repository

Volume 5

Article 22

4-1-1978

Research notes: Correlated response of certain plant traits with seed yield in soybeans

J. M. Joshi
University of Maryland, Eastern Shore

P. E. Smith
Ohio State University

be more numerous than in the previous years, the total damage from feeding by all the heteroptera was assessed by obtaining five yellow or green pods from the uppermost portion of the plant and five pods from the lowest part of the same plant; ten plants were sampled from a 9'x20' plot. The pods were shelled by hand and the beans examined for damage. The results are presented in Fig. 1.

Yeargan (1977) has shown that when four green stink bugs (A. hilare) were present per 0.3 m of row, the damaged pods were 36.5%. Our overall means, excluding the sample from ED 73.371, are 42.1% for the top and 17.9% for the bottom. No increase in damage at the bottom of the plant, in the last sample, could be due to the earlier maturity of these pods in a plant.

Acknowledgement: Facilities provided by Dr. J. M. Joshi, Director, Soybean Research Institute, University of Maryland, Eastern Shore, Princess Anne, MD, are gratefully acknowledged.

Reference

Yeargan, K. V. 1977. Effects of green stink bug damage on yield and quality of soybeans. J. Econ. Entomol. 70: 619-622.

Oswald Andrade, RPE

UNIVERSITY OF MARYLAND, EASTERN SHORE
Princess Anne, MD
and
THE OHIO STATE UNIVERSITY
Columbus, OH

1) Correlated response of certain plant traits with seed yield in soybeans.

Soybean (*Glycine max* [L.] Merr.) breeders are constantly searching for plant traits that are associated with high seed yield. Breeders have made use of correlated responses in the selection procedures for high yield and disease resistance, high protein and low oil content, and days to maturity and seed yield. Several plant traits such as lodging, plant height, shattering, maturity, etc. must be simultaneously taken into consideration in the selection process. It has been observed that plant height, late maturity and susceptibility to lodging are positively correlated with seed yield (Anand and Torrie, 1963; and Kwon and Torrie, 1964). Plant traits such as short stature and resistance to lodging have been reported to have association with seed yield (Byth *et al*., 1969). Low seed yield has been associated with indeterminate growth and glabrousness (Hartwig and Edwards, 1970). So far the study of correlated responses has not provided useful selection criteria for increasing seed yield and one of the reasons for insufficient progress in this direction may be that the traits studied so far are not more closely related to physiological processes associated with seed yield.

The present investigation was undertaken to determine the extent of association between seed yield and certain plant traits such as unthreshed plant weight, non-seed dry matter weight, number of pods, days from flowering to maturity, number of branches, undeveloped ovules, plant height and number of seeds per plant.

Materials and methods: Ten soybean cultivars were selected on the basis of their diversity in maturity, plant height and growth habit for this study. The seedlings grown in the greenhouse were randomly planted in the field and spaced 91 cm apart in 71 cm rows during 1971 at the Agronomy Farm of the Ohio State University, Columbus, Ohio. The number of single plant replications were: 'Aoda', 12; 'Cayuga', 9; 'Giant Green', 8; 'Habaro', 20; 'Hakote', 9; 'Henry', 46; 'Kent', 39; 'Kura', 13; 'Manchuria', 7; and 'Wayne', 45. Each plant was harvested at maturity at ground level, bagged separately in a cloth bag and analyzed. The unthreshed weight of the plant included air-dry weight of stem, branches, pods and seeds; non-seed dry weight was calculated by subtracting seed yield from its weight. The step-wise multiple regression method was used to calculate the relative importance of traits associated with seed yield.

Results and discussion: The data on ten soybean cultivars for certain plant traits have been given in Table 1. Plant traits which contribute most in improving seed yield have been listed in order of their importance in Tables 2 and 3. Unthreshed weight and non-seed dry matter weight when considered together in the step-wise multiple regression analysis, along with other traits, gave an r value of 1, after the selection of unthreshed weight and non-seed dry matter weight. Other traits which also had appreciable influence on yield could not be considered in this way. Therefore, it was desirable to evaluate these traits in two sets of data: one set with non-seed dry matter weight and the rest of the traits (Table 2), and the other set of data with unthreshed weight and the rest of the traits (Table 3). It is clear from Table 2 that substantial improvement in r values was made by non-seed dry matter weight. Variability of 98.38% in yield is due to non-seed dry matter weight. Number of pods/plant is the second important trait which, along with

Table 1

Values/plant for certain traits in 10 soybean cultivars

Cultivar	Unthreshed wt. (g)	Non-seed dry matter wt. (g)	Flowering to maturity (Days)	Pods (#)	Branches (#)	Undeveloped ovules (#)	Height (cm)	Seeds (#)	Seed yield (g)
Aoda	47.8	20.6	99.7	68.5	15.6	36.8	32.3	80.4	27.2
Cayuga	23.5	9.3	59.2	46.3	5.9	15.3	33.1	102.3	14.2
Giant Green	22.9	9.8	67.8	39.3	6.0	15.8	25.4	59.4	13.1
Habaro	32.8	13.1	75.2	66.0	7.7	17.1	28.9	114.4	19.7
Hakote	31.9	12.8	86.4	50.6	10.3	16.7	25.6	76.3	19.1
Henry	49.4	21.4	83.8	81.3	11.8	32.4	43.6	171.5	28.0
Kent	99.2	40.2	117.7	150.4	15.5	83.8	59.6	318.1	59.0
Kura	43.1	18.4	105.6	56.9	11.5	14.9	20.6	86.8	24.7
Manchuria	24.0	9.1	68.7	52.0	5.6	12.0	20.4	89.3	14.9
Wayne	78.4	30.8	97.1	132.1	10.5	57.0	52.7	280.5	47.6

non-seed dry matter weight, improves the r up to 0.9977. These two traits accounted for 99.53% of the variability in yield.

Table 2

Step-wise multiple regression of certain traits with seed yield (unthreshed weight excluded)

Dependent variable	r	r^2	% increase in RSQ	Standard error	F value
Non-seed dry matter weight	0.9919	0.9838	98.38	2.0515	486.77
Pods	0.9977	0.9953	1.15	1.1790	17.22
Days from flowering to maturity	0.9983	0.9967	0.14	1.0757	2.41
Branches	0.9987	0.9975	0.08	1.0229	1.64
Undeveloped ovules	0.9993	0.9986	0.11	0.8590	3.10
Height	0.9998	0.9995	0.09	0.5630	6.31
Seeds	0.9998	0.9996	0.01	0.6693	0.12

Table 3

Step-wise multiple regression of certain plant traits with seed yield (non-seed dry matter weight excluded)

Dependent variable	r	r^2	% increase in RSQ	Standard error	F value
Unthreshed weight	0.9987	0.9974	99.74	0.8151	3126.10
Branches	0.9995	0.9990	0.16	0.5525	10.41
Pods	0.9996	0.9991	0.01	0.5575	0.88
Height	0.9997	0.9993	0.02	0.5528	1.82
Undeveloped ovules	0.9997	0.9994	0.01	0.5550	0.44
Days from flowering to maturity	0.9998	0.9995	0.01	0.5744	0.74
Seeds	0.9998	0.9995	0.00	0.7001	0.02

The r value between unthreshed weight and seed yield was 0.999 (Table 3). Unthreshed weight and number of branches together improved the r value to 0.9995 and accounted for 99.90% of the variability in seed yield. It was further noted that the standard error of the estimate was lowest at this point and thereafter it started to increase. This was an indication that no appreciable gain in seed yield could be made by considering other traits.

These data suggest that selection based on non-seed dry matter weight or unthreshed weight should be helpful in improving soybean yield. Since it is easier to record unthreshed weight than non-seed dry matter weight and in view of its higher r value with seed yield, more emphasis should be placed on unthreshed weight in the selection process.

References

Anand, S. C. and J. H. Torrie. 1963. Heritability of yield and other traits and interrelationships among traits in the F_3 and F_4 generations of three soybean crosses. Crop Sci. 3: 508-511.

Byth, D. E., C. R. Weber and B. E. Caldwell. 1969. Correlated truncation selection for yield in soybeans. Crop Sci. 9: 699-702.

Hartwig, E. E. and C. J. Edwards, Jr. 1970. Effect of morphological characteristics upon seed yield in soybeans. Agron. J. 62: 64-65.

Kwon, S. H. and J. H. Torrie. 1964. Heritability of and interrelationships among traits of two soybean populations. Crop Sci. 4: 196-198.

J. M. Joshi, Univ. of Maryland, Eastern Shore
P. E. Smith, The Ohio State University

UNIVERSITY OF MISSOURI at ST. LOUIS
Department of Biology
St. Louis, MO 63130
and
UNIVERSITY OF ILLINOIS at URBANA-CHAMPAIGN
Department of Agronomy
Urbana, IL 61801

1) Screening soybean seed for lectin content.*

Soybeans [Glycine max (L.) Merr.] contain at least four glycoproteins that are capable of clumping red blood cells (Catsimpoolas and Meyer, 1969;

*Research supported in part by the Illinois Agricultural Experiment Station, a grant to Theodore Hymowitz by the Illinois Crop Improvement Association and a faculty research grant to S. G. Pueppke by the University of Missouri at St. Louis.